

CLAIMS

What is claimed is:

1. A method of selectively exposing resist with radiation, the method comprising:
 - 1) directing the radiation at a reflective reticle, wherein the reflective reticle includes:
 - a first reflective region;
 - a second reflective region; and
 - an absorptive region;wherein at least part of the first reflective region and at least part of the second reflective region are on respective opposite sides of the absorptive region;
 - 2) reflecting the radiation off the reflective reticle, wherein the first reflective region and the second reflective region reflect incident coherent light out of phase relative to one another, and wherein the radiation is absorbed by the absorptive region; and
 - 3) directing the radiation reflected off the reticle to the resist.
2. The method of claim 1, wherein the first reflective region and the second reflective region reflect radiation substantially 180 degrees out of phase with one another.
3. The method of claim 1,
wherein the reflective reticle includes:
 - a substrate; and
 - a reflector on the substrate;wherein the reflector includes a plurality of reflective layers;
wherein the reflector has more of the reflective layers in one of the reflective regions than in the other of the reflective regions; and
wherein at least part of the first reflective region and at least part of the second reflective region are on respective opposite sides of the absorptive region.

4. The method of claim 3,
wherein the number of the reflective layers in the transition region varies with location within the transition region; and
wherein the transition region borders both of the reflective regions.
5. The method of claim 4, wherein the reflector, within the transition region, has a substantially continuously variable number of the reflective layers.
6. The method of claim 3, wherein the reflector has a total thickness of from about 280 nm to about 420 nm.
7. The method of claim 3, wherein the absorptive region is an exposed part of the substrate, with substantially no reflective material thereupon.
8. The method of claim 1, wherein the radiation includes extreme ultraviolet radiation having a wavelength from about 30 to about 700 Angstroms.
9. A method of selectively exposing resist with radiation, the method comprising:
 - 1) directing the radiation at a reflective reticle, wherein the reflective reticle includes:
 - a substrate that includes an absorptive material; and
 - a reflector on the substrate;
 - wherein the reflector includes a plurality of reflective layers;
 - wherein the reticle includes a first reflective region and a second reflective region;
 - wherein the reticle includes an absorptive region; and
 - wherein the reflector has more of the reflective layers in one of the reflective regions than in the other of the reflective regions;
 - 2) reflecting the radiation off the reflective reticle, wherein the reflecting includes:

reflecting the radiation in a first phase from the first reflective region;
and

reflecting the radiation in a second phase from the second reflective region;

wherein the second phase that is different from the first phase; and

wherein the radiation is absorbed by the absorbed region; and

3) directing the radiation reflected off the reticle to the resist.

10. The method of claim 9,

wherein the number of the reflective layers in the transition region varies with location within the transition region; and

wherein the transition region borders both of the reflective regions.

11. The method of claim 9, wherein the reflector has a total thickness of from about 280 nm to about 420 nm.

12. The method of claim 9, wherein the reflective layers each include a layer of molybdenum joined to a layer of silicon.

13. The method of claim 9, wherein the reflective layers each include a layer of molybdenum and a layer of silicon, with a layer of boron carbide therebetween.

14. The method of claim 9, wherein the substrate includes a low thermal expansion material.

15. The method of claim 9, wherein the absorptive region is an exposed part of the substrate, with substantially no reflective material thereupon.

16. The method of claim 9, wherein the radiation includes extreme ultraviolet radiation having a wavelength from about 30 to about 700 Angstroms.

17. A method of fabricating a reflective reticle, the method comprising:
depositing a plurality of reflective layers on an absorptive substrate;
selectively removing at least some of the reflective layers from parts of the
reticle, so as to form:

an absorptive region with substantially all of the reflective layers
removed; and

first and second reflective regions, wherein the first reflective region
has more of the reflective layers than the second reflective regions.

18. The method of claim 17, wherein the selectively removing includes
etching.

19. The method of claim 18, wherein the etching includes reactive ion
etching.

20. The method of claim 19,
wherein the selectively removing also includes creating a transition region
linking the reflective regions;
wherein the transition region has a variable number of the reflective layers;
and
wherein the variable number is between that of the reflective regions.

21. The method of claim 17, wherein the reflective layers have a total
thickness, after the selectively removing, of from about 280 nm to about 420 nm.

22. The method of claim 17, wherein the reflective layers each include a layer
of molybdenum joined to a layer of silicon.

23. The method of claim 17, wherein the reflective layers each include a layer
of molybdenum and a layer of silicon, with a layer of boron carbide therebetween.

24. A reflective reticle comprising:
a first reflective region;
a second reflective region; and
an absorptive region;
wherein, the first reflective region and the second reflective region reflect incident coherent radiation out of phase relative to one another; and
wherein at least part of the first reflective region and at least part of the second reflective region are on respective opposite sides of the absorptive region.

25. The reticle of claim 24, wherein the first reflective region and the second reflective region reflect radiation substantially 180 degrees out of phase with one another.

26. The reticle of claim 24, wherein the reflective reticle includes:
a substrate; and
a reflector on the substrate;
wherein the reflector includes a plurality of reflective layers;
wherein the reflector has more of the reflective layers in one of the reflective regions than in the other of the reflective regions; and
wherein the reflector includes a transition region in which the reflector has fewer of the reflective layers than in the one of the reflective layers, and in which the reflector has fewer of the reflective layers than in the other of the reflective layers.

27. The reticle of claim 26,
wherein the number of the reflective layers in the transition region varies with location within the transition region; and
wherein the transition region borders both of the reflective regions.

28. The reticle of claim 27, wherein the reflector, within the transition region, has a substantially continuously variable number of the reflective layers.

29. The reticle of claim 26, wherein the reflector has a total thickness of from about 280 nm to about 420 nm.

30. The reticle of claim 26, wherein the absorptive region is an exposed part of the substrate, with substantially no reflective material thereupon.

31. A reflective reticle comprising:
a substrate that includes an absorptive material; and
a reflector on the substrate;
wherein the reflector includes a plurality of reflective layers;
wherein the reticle includes a first reflective region for reflecting radiation in a first phase;
wherein the reticle includes a second reflective region for reflecting radiation in a second phase that is different than the first phase;
wherein the reticle includes an absorptive region; and
wherein the reflector has more of the reflective layers in one of the reflective regions than in the other of the reflective regions.

32. The reticle of claim 31,
wherein the number of the reflective layers in the transition region varies with location within the transition region; and
wherein the transition region borders both of the reflective regions.

33. The reticle of claim 31, wherein the reflector has a total thickness of from about 280 nm to about 420 nm.

34. The reticle of claim 31, wherein the reflective layers each include a layer of molybdenum joined to a layer of silicon.

35. The reticle of claim 31, wherein the reflective layers each include a layer of molybdenum and a layer of silicon, with a layer of boron carbide therebetween.

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36. The reticle of claim 31, wherein the substrate includes a low thermal expansion material.

37. The reticle of claim 31, wherein the absorptive region is an exposed part of the substrate, with substantially no reflective material thereupon.